



# Autopsy on an Empire: Understanding Mortality in Russia and the Former Soviet Union

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## **Autopsy on an Empire: Understanding Mortality in Russia and the Former Soviet Union**

Elizabeth Brainerd and David M. Cutler

**T**he 1990s were a decade of turmoil for the formerly socialist countries. Besides the political, economic and social upheavals endured by these populations, many of these countries experienced a demographic disaster in the form of sharply rising death rates. In Russia, male life expectancy at birth fell from 64.2 years in 1989 to 57.6 years in 1994, a decline of 6.6 years in just half a decade. Female life expectancy at birth fell by 3.3 years over the same period. To put this decline in perspective, it took the past 30 years for the United States to increase life expectancy by this much. Russia's life expectancy today ranks 122<sup>nd</sup> in the world, at the same level as North Korea and Guyana.

The mortality crisis is not limited to Russia. Across the western countries of the former Soviet Union—the countries that we term “the mortality belt” and that range from Estonia in the north to Ukraine in the south—there have been significant declines in male life expectancy at birth, ranging from 3.3 years (Belarus) to nearly 5 years in Estonia and Latvia. Life expectancy for women fell substantially as well.

But not all countries fared this poorly. The countries that directly border this “mortality belt” and that also experienced a severe economic shock in the 1990s—Poland, the Czech and Slovak Republics, Hungary and Romania—recorded

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negligible increases in mortality rates during their transition from communism, and since the mid-1990s many of these countries have enjoyed the fastest increases in life expectancy recorded in their recent history.

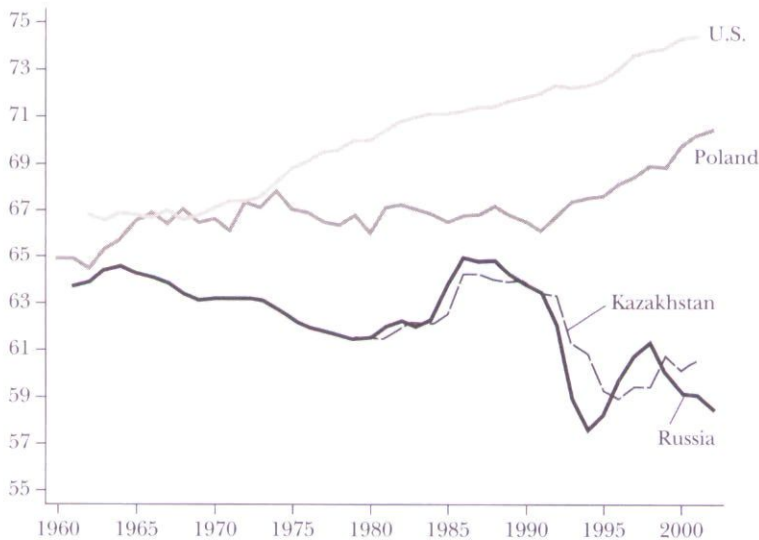
Understanding why mortality in Russia and many of its neighboring countries increased so rapidly is a central research and policy question. Using both existing findings and our own analysis of cross-country and Russian survey data, we discuss and analyze possible causes of the mortality crisis in the former Soviet Union, as well as the contrasting dramatic improvement in mortality rates in the late 1990s in nearby countries. We begin by describing the overall trends in death rates in the region, providing an overview of changes in mortality by region, age and cause. We next explore the possible causes of the dramatic swings in mortality across the region, focusing on six broad factors that have been discussed in the literature: the breakdown in the medical care system (Ellman, 1994); traditional risk factors such as obesity and smoking; increased alcohol consumption (Leon et al., 1997); changes in the composition of the diet (Ginter, 1996); material deprivation (Field, 1995); and levels of psychosocial stress and changing expectations about the future (Shapiro, 1995; Cornia and Panicià, 2000). Our results point to two factors as being most important: alcohol, especially as it relates to external causes of death (homicide, suicide and accidents) and stress associated with a poor outlook for the future. However, a large residual remains to be explained.

## **Mortality Trends in the Former Soviet Union**

We start by examining mortality trends in Russia and the other regions of the former Soviet Union. Figure 1 illustrates the erratic changes in life expectancy experienced in most of these countries in recent years, in contrast to the slowly evolving changes in life expectancy recorded in the United States. While life expectancy for the Russian republic had nearly reached that of the United States by the early 1960s, it stagnated over the next decade, resulting in a nearly eight-year gap in life expectancy between Russia and the United States by 1980. The post-1984 period is marked by large swings in life expectancy. Russia experienced a striking improvement in mortality during Gorbachev's anti-alcohol campaign (1985–1987), when life expectancy increased nearly three years. From there, however, the situation deteriorated dramatically. The deterioration began in 1990 and lasted until the mid-1990s, coincident with the period of greatest economic, political and social instability in most countries. The six-year reduction in male life expectancy at birth in Russia between 1989 and 1994 is almost unprecedented in its speed and scope, though it was nearly matched by the declines in life expectancy in many of Russia's western neighbors. Over the same period, male life expectancy fell by 4.6 years in Estonia, 4.5 years in Latvia, 4.2 years in Lithuania and 3.7 and 3.3 years, respectively, in Ukraine and Belarus. After 1994, the situation began to improve. Between 1994 and 1998, life expectancy in Russia increased by over 3 years. Most of the gains were eroded, however, following Russia's 1998 financial crisis; male life



Figure 1  
Trends in Male Life Expectancy at Birth, 1958–2002



expectancy fell continually from peak of 61.3 years in 1998 to only 58.5 years in 2002.<sup>1</sup>

Life expectancy also fell in central Asia and the Caucasus, the former Soviet republics to the south and east of Russia, but in most countries the declines were neither as dramatic nor long lasting as in the western former Soviet Union. The evolution of life expectancy in Kazakhstan is also shown for illustration in Figure 1. Kazakhstan registered the largest decline in life expectancy in this group, with male life expectancy at birth falling by five years between 1989 and 1996; the smallest decline in this region occurred in Uzbekistan, where male life expectancy fell by 1.6 years between 1990 and 1994. Among the three Caucasus countries—Armenia, Azerbaijan and Georgia—declines in life expectancy ranged from 1.6 years (Armenia) to 4.2 years (Azerbaijan) in the early 1990s.

In contrast, none of the east European countries experienced a prolonged decline in life expectancy in the 1990s, and some did not see any material setback, despite large declines in per capita income, rising unemployment and sweeping

<sup>1</sup> Although many statistics about the former Soviet bloc are unreliable, demographic data are believed to be an exception: registration of vital events is nearly complete, and the coding of broad categories of death is reasonably accurate (Anderson and Silver, 1997; Shkolnikov et al., 2001). As a result, there is widespread agreement among demographers and epidemiologists that the fluctuations in mortality rates we describe are real and do not reflect a change in how the statistics were collected. However, mortality data are less reliable in some countries of central Asia and the Caucasus. Inconsistencies in the reporting of deaths at the oldest ages have been reported in some countries, and Georgia implemented a fee for death registration in the early 1990s, which likely led to underreporting of deaths (Badurashvili et al., 2001). Data for these countries should be interpreted with caution.

economic and political changes. The most successful economic reformers—the Czech Republic, Poland, Hungary and Slovenia—registered near-continual increases in life expectancy since the start of their reforms. This experience differs not only with the neighboring “mortality belt” countries, but also with the experience of the previous three decades, in which life expectancy stagnated in a pattern similar to that of the Soviet Union. Life expectancy did fall in Bulgaria and Romania, but these declines are small relative to those that occurred in the western region of the former Soviet Union. The life expectancy experience of Poland, which is the largest country by population in eastern Europe and typical for the region, is shown in Figure 1. In general, the patterns for female life expectancy at birth are similar to those for men, although the magnitude of the changes is smaller.<sup>2</sup>

### **Mortality and the Economy**

Changes in mortality are clearly related to the economic health of the country. Figure 2 shows the relation in more detail: we relate the log change in age-standardized male mortality between 1989 and 1994 to the log change in real per capita GDP over the same time period. The two are highly related: the correlation coefficient is  $-.60$ . Countries like Ukraine with poor economic growth had very large increases in mortality. Poland, the Czech Republic and Slovenia are on the opposite end. Even in the context of this relationship, however, Russia is an outlier: mortality increased more than could be expected given the change in reported GDP. The mortality increase in Russia is even more extreme if the decline in Russia's GDP is substantially overstated (as Shleifer and Treisman argue is likely in their paper in this symposium). However, the relationship between mortality change and GDP growth is less true over the subsequent years of the 1990s. When we redid this calculation for the period from 1994 to 2000, the best-fit line appears nearly horizontal, with a correlation of just  $-.13$ . Moreover, for the period from 1994–2000, Russia is almost exactly on the best-fit line, with a roughly average performance for this group of countries in both economic growth and mortality.

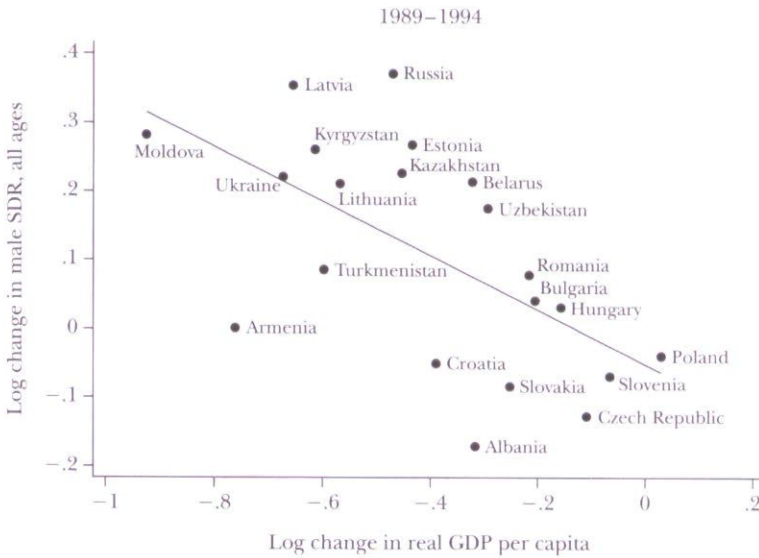
The strong correlation between mortality change and economic growth begs for a more detailed analysis. What mechanisms underlie the link between economic growth and health? Why did the relationship get weaker over time? Why was Russia an outlier in the 1989–1994 period?

### **Deaths by Age, Cause and Socioeconomic Status**

In countries facing economic shocks, mortality often increases most for infants and the elderly (Cutler et al., 2002). The mortality increases in the countries of the former Soviet Union do not follow this expected pattern, however. During the period from 1989 to 1994, the years of the largest increase in death rates, the death rate for Russian men aged 35–44 rose by 74 percent. Similar although slightly lower

<sup>2</sup> See the appendix of Brainerd and Cutler (2004) for graphs showing trends in male and female life expectancy in all countries of eastern Europe and the former Soviet Union.

Figure 2

**Correlation Between Log Change in Male Standardized Death Rate and Log Change in Real GDP Per Capita, 1989 to 1994**

Notes: For several countries GDP data are missing for 1989, so Figure 2 uses 1990 data instead. Georgia, Bosnia-Herzegovina, FYR Macedonia and Serbia are omitted due to missing data.

increases were seen throughout men's ages from 25–54. Meanwhile, mortality among Russian men aged 65–74 rose by only 25 percent between 1989 and 1994; for men aged 75–84, mortality rates increased by just 14 percent. The pattern for women is similar, again with a peak around ages 35–44 and substantially smaller increases at older ages. Infant mortality (death during the first year of life) decreased, and death rates for children under the age of 14 changed little.

Table 1 shows data on the share of the total increase in mortality that is accounted for by different causes. Forty-two percent of the increase in male mortality was the result of greater mortality from cardiovascular disease; within this category, 21 percentage points of the total increase in male mortality was due to the increase in deaths due to ischaemic heart disease (a reduced flow of blood to the heart muscle). Cardiovascular disease is the leading cause of death in Russia, as in the United States, so the importance of this change is not surprising. However, we typically think of cardiovascular disease as a long-term process responding to life events building up over many years or decades, so the magnitude of this increase in a short time is unusual.

Second in importance are external causes of death. The most important items in this category are accidental alcohol poisoning, unspecified violent deaths, homicide and suicide. A well-hidden secret of the Soviet Union was the extremely high death rate due to external causes. In 1989, for example, death due to external causes was three times higher among men in Russia than in the European Union.



Table 1

**Contribution to Change in Mortality by Cause, all Ages, Russia, 1989–1994**

	<i>Men</i>	<i>Women</i>
Percentage contribution to change in death rate:		
Circulatory diseases	41.8	46.6
Of which:		
<i>Ischaemic heart disease</i>	21.3	15.5
<i>Cerebrovascular disease</i>	10.4	16.7
<i>Other circ. diseases</i>	10.1	14.4
External causes	32.7	20.1
Of which:		
<i>Accidental alcohol poisoning</i>	7.0	5.7
<i>Homicide</i>	4.7	3.6
<i>Suicide</i>	4.5	1.0
<i>Other external causes</i>	6.3	4.2
Ill-defined conditions	10.0	21.0
Pneumonia	3.3	1.4
Diabetes	0.5	2.0
Bronchitis	2.6	0.0
Tuberculosis	1.9	0.5

Deaths due to external causes rose dramatically in Russia in the early 1990s, virtually doubling for both men and women. These changes account for one-fifth (women) to one-third (men) of the total increase in deaths between 1989 and 1994. Both suicide and homicide are important across the region; by the mid-1990s Lithuania had achieved the dubious distinction of having the highest male suicide rate in the world. We return to this cause, especially as it relates to alcohol, at a later point.

Official Russian data do not differentiate deaths by socioeconomic status (nor do they in the United States), but other evidence suggests that mortality rates increased the most among lower socioeconomic groups. For example, men with low levels of education were disproportionately affected by the increase in mortality (Shkolnikov et al., 1998; Plavinski, Plavinskaya and Klimov, 2003). Data from the Russian Longitudinal Monitoring Survey (described below) support this observation. Over the period 1995–2001, the average annual mortality rate of people aged 30–55 was 0.74 percent. The mortality rate ranged from 1.86 percent of those with primary education to 0.23 percent of those with higher education.

### Sources of Data

In the next sections, we assess different explanations for these patterns in mortality. We rely on two main approaches, one using national-level data and one using data from a Russian survey of households.

For the analysis using national data, we focus on the 23 countries of the former Soviet Union and eastern Europe. We use the January 2004 mortality data from the

WHO Mortality database at (<http://www.euro.who.int/hfad>), supplemented with data from national statistical yearbooks. When we carry out regression results, we focus on explaining mortality among prime-age men (ages 25–64), since this group is where the mortality crisis is most acute. We have also examined mortality rates for women, and since the results are similar, we do not report them here. To isolate the theories we consider, we look both at overall mortality and also at mortality grouped into three broad causes: cardiovascular disease, external causes of death and all other. Economic and social variables for these countries are from the WHO Health for All Database (2004), the World Bank's *World Development Indicators* (2003), the EBRD *Transition Report* (2003) and the TransMONEE database (2003).

Our second approach is to use panel data from the Russian Longitudinal Monitoring Survey (RLMS). The RLMS is a nationally representative panel survey conducted from 1992–2002; however, because of concerns about data quality in the early years, the results we report use the data from 1994–2002. The sample comprises roughly 4,000 households and 11,000 individuals in each round. The RLMS contains extensive information on income, health status, employment and demographic characteristics of individuals and families, as well as on individual behaviors such as smoking and drinking. A detailed description of the sampling design and implementation of the RLMS is available at the RLMS website at (<http://www.cpc.unc.edu/rlms>). For families with at least one member surviving, the survey asks if anyone died during the time period. Our analysis of mortality in subsequent sections is based on these multiple-person households (which include about 85 percent of the population).<sup>3</sup> Trends in mortality in the RLMS match trends from the aggregate data, although the level of mortality in the RLMS is 10–20 percent lower than the national data. Using these data, we can control for a number of individual characteristics: age, education, income, year of survey and region of the country. We also control for past medical events such as whether the person ever had a heart attack, was diabetic or had a stroke.

## Suspect 1: The Acute Medical Care System

One of the Soviet Union's most remarkable achievements was the development of a universal health care system that extended across the country and provided a wide range of medical services even in the remotest areas; for a description of the Soviet health care system, see Knaus (1981) and Ryan (1989). The system was particularly successful in reducing deaths due to infectious diseases and deaths in infancy. The only medical expenditures paid for out-of-pocket were those for (subsidized) prescription drugs and to hospital staff to ensure better care. (Significant payments to doctors—on the order of one to two months of average

<sup>3</sup> In regressions using these data, we stack each round of the survey so that each regression uses all rounds of the survey and includes multiple observations on individuals. Standard errors are clustered by individual to correct for these multiple observations.



wages—were reported, but relatively uncommon.) Central planning did hamper the effectiveness of the health care system in many areas, however. Soviet central planners emphasized growth in quantitative indicators such as doctors and hospital beds per capita, rather than quality of care or results, and even set quantitative targets for the number of beds occupied and the number of procedures performed in hospitals (Twigg, 1998). There were waits for medical care, as for everything else in the Soviet Union. However, the old Soviet health care system did deliver a substantial volume of care.

This health system has deteriorated since the disintegration of the Soviet Union. Government support for health services declined and out-of-pocket expenditures for patients increased sharply. Many hospitals and clinics in the former Soviet Union have opened fee-paying services to compensate for funding shortfalls. Data from the Russian Longitudinal Monitoring Survey indicate a dramatic increase in the number of patients paying for care in Russia and in the price of that care: in 1994, only 14 percent of individuals hospitalized in the month prior to the survey reported that they paid money for medical care or treatment while in the hospital; of those that paid, the median payment amounted to 41 percent of the median monthly per capita income. By 1998, 45 percent of respondents indicated that they had paid for medical care while in the hospital, and the median payment exceeded two-thirds of the median monthly per capita income. Anecdotal evidence indicates that while modern drugs are prescribed for conditions such as cardiovascular disease, many patients cannot afford to purchase them (Reiss et al., 1996). Funding difficulties may also have led to a decrease in the capacity and effectiveness of the health care system.

Difficulties in Russia's medical care system might help to explain the increase in mortality (Ellman, 1994). We first consider curative acute medical care, like the high-tech treatment of people who have had an adverse health event. We then consider preventive care, like antihypertension medication that reduces the probability of a stroke or heart attack.

To assess the importance of changes in acute care in explaining Russia's mortality crisis, one would like to identify whether the increase in death rates was due to an increase in the number of adverse health events, such as heart attacks and strokes, or whether it is due to an increase in the fatality rate after such events occur, which would suggest a role for declining health care services in explaining the mortality crisis. Although data are limited, the fatality rate after an adverse health event seems to have changed little during the 1990s. For example, an extensive study of stroke incidence and mortality in Novosibirsk (located in western Siberia) between 1987 and 1994 found that while the case fatality rate was relatively high (28–43 percent), case fatality rates remained unchanged over the period; the substantial increase in stroke mortality in Novosibirsk was due to an increase in attacks rather than to higher fatality rates (Stegmayr et al., 2000). Indeed, medical care for some types of illnesses apparently improved in Russia in the 1990s: the recent decline in childhood leukemia deaths, for example, is attributed to improvements in care (Shkolnikov, McKee, Leon and Chenet, 1999).

Other evidence comes from the maternal mortality rate (death during childbirth), which is almost entirely preventable through medical intervention and thus provides a good measure of how the medical care system is providing acute care. The maternal mortality rate did not change appreciably in Russia over the 1990s, rising from 49.0 deaths per 100,000 live births in 1989 to 53.3 deaths in 1995, then falling to 39.7 deaths by 2000. This rate is high compared with high-income countries like the United States, where the maternal mortality rate in 2000 was 9.8 per 100,000 live births. But the Russian figures suggest that the capacity of its basic health care system remained essentially unchanged.

In Table 2, we present a series of cross-country regression results for various explanations discussed throughout this paper. The dependent variable in these regressions is the log change in mortality rates for men aged 25–64, using all countries among the 23 transition economies of the former Soviet bloc for which data are available. The first column of Table 2 reports the relation between log changes in prime age male mortality and log changes in maternal mortality between 1989 and 2000, which in this regression is our measure of the acute care medical system. There is little relation between maternal mortality and male mortality. Indeed, adult male mortality actually fell in countries where maternal mortality rose, though not statistically significantly.

We considered other measures of the efficacy of the medical system as well, focusing more directly on the availability of medical care resources. The second column of Table 2 relates the change in male mortality to the change in public and private medical spending. While such a regression clearly raises endogeneity issues (is a change in health outcomes causing a change in health care spending, or is a change in health care spending causing a change in health outcomes?), our hope is that the massive changes in health care systems over this time period generate large differences in medical spending across countries. However, neither measure is statistically significant. Overall, there is little evidence that a breakdown in the acute health care system is a primary cause of the mortality crisis.

The situation with preventive medications is more difficult to assess. The Russian Longitudinal Monitoring Survey indicates whether a person takes “any medication,” but not the type of medication. Still, use of “any medication” did not decline in Russia: in both 1993 and 2000, about 38 percent of Russian adults reported taking any medication. There is no broad-scale evidence that preventive care of this sort decreased.

## **Suspect 2: Traditional Risk Factors for Cardiovascular Disease**

The finding that the case fatality rate for cardiovascular disease did not increase indicates that Russia experienced an increase in the incidence of serious cardiovascular illnesses. Five traditional risk factors for cardiovascular disease have been identified in the (western) literature: hypertension or high blood pressure, high cholesterol, diabetes, obesity and smoking. However, none of these factors



Table 2

**Cross-Country Analysis of Factors Leading to Increased Mortality, 1989–2000***(dependent variable: log change in standardized mortality rate, all causes, men age 25–64)*

<i>Independent variables (log changes)</i>	(1)	(2)	(3)	(4)	(5)	(6)	(7)
<i>Medical system</i>							
Maternal mortality rate	-.059 (.068)						
Public medical spending		.087 (.070)					
Private medical spending		.016 (.021)					
<i>Alcohol consumption<sup>a</sup></i>			.243* (.133)				
<i>Fruit and vegetable consumption<sup>a</sup></i>				-.178 (.121)			
<i>Expectations and stress</i>							
Male suicide rate					.274* (.138)		
Survey expectations <sup>b</sup>						.452 (.483)	
Minimum wage/average wage							-.098* (.051)
N	22	22	22	23	23	17	18
R <sup>2</sup>	.036	.112	.135	.095	.287	.082	.133

Note: Robust standard errors are reported in parentheses.

<sup>a</sup> Change between 1992 and 2000 for most countries.

<sup>b</sup> Change between 1991/1992 and 1996 for most countries.

\* Statistically significant at the 10 percent level or less.

changed in Russia during the 1990s in a way that seems likely to explain the sharp increase in cardiovascular disease mortality.

With regard to obesity, a standard measure is the Body Mass Index (BMI)—weight in kilograms divided by height in meters squared. According to the World Health Organization, a person is overweight if the BMI is greater than 25 and less than 29.9 and obese if BMI is 30 or higher. Obesity has a direct impact on health and is also related to high blood pressure, high cholesterol and diabetes. Over the period from 1993–2000, obesity increased only slightly for Russian men (10 percent in 1993 to 12 percent in 2000) and women (27 percent in 1993 to 28 percent in 2000).<sup>4</sup>

We assess the importance of obesity changes using the individual data from the RLMS. Table 3 presents a series of regressions for adult male mortality. In all cases,

<sup>4</sup> The level of obesity among Russian men is only half the level in the United States (Cutler, Glaeser and Shapiro, 2003). For women, obesity rates are about the same.



Table 3

**Logistic Regressions for Men Age 18 and Over Dying in the Russian Longitudinal Monitoring Survey, 1994–2002**

(dependent variable: dummy variable for whether the person died)

Independent variable	(1)	(2)	(3)	(4)	(5)
Age	1.06*** (12.3)	1.06*** (12.4)	1.06*** (12.7)	1.06*** (12.0)	1.06*** (12.4)
Log (income per capita)	-.903* (1.75)	-.902* (1.77)	-.920 (1.40)	-.906* (1.70)	-.906* (1.68)
Poor health (1 = yes)	2.26*** (6.34)	2.27*** (6.39)	2.31*** (6.47)	2.26*** (6.35)	2.27*** (6.34)
BMI	-.729*** (3.66)	-.729*** (3.63)	-.732*** (3.65)	-.729*** (3.62)	-.728*** (3.64)
BMI squared	1.005*** (3.38)	1.01*** (3.35)	1.01*** (3.39)	1.01*** (3.32)	1.01*** (3.36)
Ever had a heart attack	1.50** (2.31)	1.51** (2.34)	1.53** (2.39)	1.52** (2.37)	1.51** (2.36)
Diabetic	1.76*** (2.44)	1.77*** (2.48)	1.79*** (2.52)	1.78*** (2.49)	1.77** (2.48)
Ever had a stroke	1.79*** (2.68)	1.81*** (2.74)	1.83*** (2.78)	1.80*** (2.72)	1.82*** (2.74)
Smoker	1.60*** (3.80)	1.57*** (3.62)	1.56*** (3.53)	1.56*** (3.59)	1.57*** (3.62)
Alcohol consumption	—	1.001** (2.25)	1.001** (2.16)	1.001** (2.22)	1.001** (2.25)
In poverty or extreme poverty	—	—	1.10 (0.59)	—	—
Received fuel subsidies	—	—	-0.974 (0.06)	—	—
Sold goods for food	—	—	1.19 (0.69)	—	—
% expenditures on food	—	—	1.15 (0.48)	—	—
Positive expectations	—	—	—	-.706 (1.59)	—
Min. wage as % of average wage	—	—	—	—	1.01 (0.38)
No. died	432	432	432	432	432
N	17092	17092	17092	17092	17092
Pseudo R <sup>2</sup>	.163	.165	.165	.165	.165

Notes: Coefficients are reported as odds ratios. Z-statistics in parentheses. Standard errors are calculated using the Huber/White method and are corrected for individual clustering. All regressions include controls for marital status, education level, year of the survey and large region (North, Central, Volga, North Caucasus, Urals, West Siberia, East Siberia, Moscow/St. Petersburg). A binge drinker is defined as someone who reports their "usual" alcohol consumption in the last 30 days as 120 grams or more of hard alcohol per day.

\*\*\* Statistically significant at the 1 percent level or less.

\*\* Statistically significant at the 5 percent level or less.

\* Statistically significant at the 10 percent level or less.

the dependent variable is a dummy variable for whether a person died. The coefficients are presented as "odds ratios" for death among men; that is, the coefficient is the chance of death for those with this factor divided by the chance of death for those without it. Thus, a coefficient of 1 means that this factor does not alter the chance of death; a coefficient of 1.5 means that an individual's odds of dying are 50 percent greater if they have this factor. The first column includes controls for age, income,<sup>5</sup> health and other factors. Both Body Mass Index and its square are also included, because there is typically a U-shaped relation between obesity and mortality risk. Across households, obesity clearly is a significant predictor of mortality. But the very slight change in obesity observed in Russia predicts only minor changes in mortality risk: the change in BMI over the 1990s predicts an increase in mortality rates of only .02 percent.

Smoking is associated with higher rates of cardiovascular disease, along with many cancers. About 60 percent of Russian men smoke, nearly twice the share as in Europe. Russian women smoke less than their European counterparts. The regression in the first column of Table 3 shows that for male smokers in Russia the odds of dying are 60 percent higher than for nonsmokers. However, use of tobacco products did not increase greatly in Russia over the 1990s. The share of adults who smoke was flat for men and rose only slightly for women. Indeed, lung cancer death rates in Russia have fallen sharply since the early 1990s, suggesting that cardiovascular disease mortality increase is not a result of a long-term response to smoking trends (Shkolnikov et al., 1999).

Hypertension, high cholesterol and diabetes are other well-known risk factors for cardiovascular disease. Data on these factors in countries of the former Soviet Union are difficult to obtain. (Even in western countries, precise data on the prevalence of elevated risk are sparse, since most people with moderately elevated risk are asymptomatic and thus may not enter the medical system.) Still, the evidence suggests that these traditional risk factors did not change materially and, indeed, that they are no higher in Russia and the Baltics than in western populations. For example, the Novosibirsk stroke study found that the risk factors for stroke remained stable or even improved in the Novosibirsk population over the period (Stegmayr et al., 2000). Epidemiological studies of cardiovascular risk factors in the Baltic countries also find mildly favorable trends in these risk factors throughout the 1990s (Kristenson et al., 1997; Domarkienė et al., 2003).

Traditional risk factors for cardiovascular disease thus explain relatively little of the increase in mortality in Russia. This finding leads us, as it has others, to consider nontraditional risk factors for mortality.

<sup>5</sup> The income control perhaps warrants some comment. In the cross-country data, we do not control for GDP, since we are interested in the total effect of the variables we examine on mortality, not the partial effect controlling for economic conditions. One could make the same argument about income in the micro data. We include the income control, however, to pick up the person's relative income in society, which is strongly indicative of mortality. In practice, our results are relatively similar if we include or omit the control for income.



### **Suspect 3: Alcohol**

Alcohol consumption can affect mortality in many ways. Alcohol is a direct cause of many accidental deaths. In addition, heavy alcohol consumption—especially binge drinking—could increase mortality from cardiovascular disease.

Alcohol consumption is actually slightly lower in Russia than in Europe. Per capita consumption of pure alcohol in Russia was 10.8 liters per capita, compared with 11.1 liters per capita in the European Union in 2000, according to the WHO data. But compared to their European counterparts, Russians consume a great deal more alcohol in the form of spirits rather than as beer or wine. In addition, alcohol consumption in Russia is much more likely to be binge drinking.

Figure 3 shows the trend in annual consumption of alcohol (in liters of pure alcohol per year) from two sources. The WHO data is based on official alcohol sales and have the advantage of being present for all countries, but they have the disadvantage in most countries (Russia is an exception) that they likely omit the unrecorded imports that flooded into these countries in the early 1990s. The RLMS asks individuals what alcoholic beverages they drank during the last 30 days and converts the answers into pure alcohol consumed. For comparison purposes, the graph also shows the prime age male death rate.

Both surveys show a substantial increase in alcohol consumption in the early 1990s—on the order of 25–30 percent between 1992 and 1994. The increase in alcohol consumption is consistent with a substantial reduction in price: the relative price of alcohol fell by 58 percent between December 1990 and December 1994. The change in alcohol consumption (using the WHO data) is consistent with a price elasticity of demand for alcohol of  $-.36$ , which is in the range of elasticities for other countries. Increased alcohol consumption may also be related to the increased political and economic uncertainty in Russia in the early 1990s as the transition to a market economy began in earnest.

Both surveys also show a reduction in alcohol consumption between 1994 and 1996, a time period when alcohol prices rose. After 1996, the surveys diverge. In the RLMS, alcohol consumption decreased substantially until 1998 and then increased thereafter. The WHO data show a smooth increase over most of the period. Over the entire 1992–2000 time period, alcohol consumption increased in Russia by between 27 percent (using the RLMS data) and 63 percent (using the WHO data).

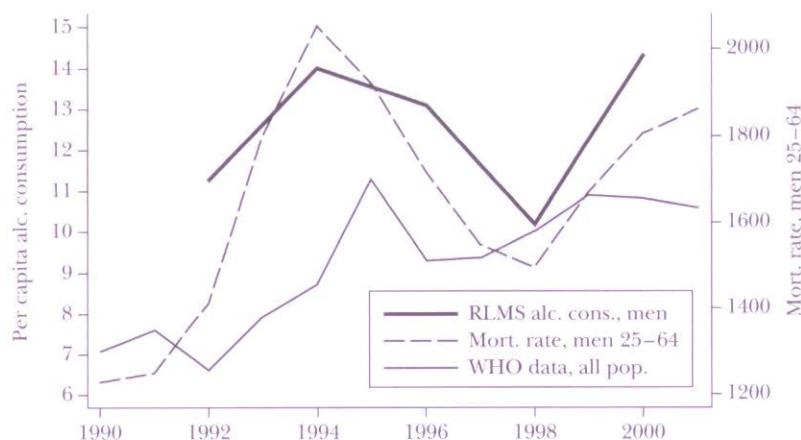
The RLMS data in particular track closely the changes in the male standardized death rate over time: alcohol consumption increased and so did mortality. Alcohol consumption also increased significantly in some of the “mortality belt” countries in the early 1990s—in particular, in Lithuania and Moldova—while it changed little or declined in the countries of eastern Europe. This pattern suggests an alcohol-based explanation for at least part of the mortality crisis.

### **Alcohol and Violent Deaths**

One way in which alcohol may affect mortality is through violent death. Accidental alcohol poisoning represents 7 percent of the increase in male mortality



Figure 3

**Alcohol Consumption and Male Standardized Death Rate (Age 25–64) in Russia**

between 1989 and 1994 and 6 percent of the increase in female mortality. In addition, alcohol may play some role in instigating murder or suicide.

Table 4 follows up on the cross-country regressions of Table 2, but the focus is now on explaining specific causes of death. The dependent variable in the first column is the change in the mortality rate from external causes among men; the dependent variable in the second column is the change in the mortality rate due to cardiovascular disease; and the dependent variable in the third column is the change in the mortality rate due to all other causes.<sup>6</sup> The first entry in the first column of Table 4 shows the relation between changes in alcohol consumption and changes in death from external causes. The coefficient on alcohol consumption is not statistically significant, but it is quite large: the 45 percent increase in alcohol consumption in Russia between 1989 and 2000 is predicted to account for 34 percent of the increase in all external causes of death.<sup>7</sup>

For 2000–2002, the RLMS also provides information on causes of death; we examine these data to look at the impact of alcohol on accidental deaths (see the working paper version of the paper for the specific results). Alcohol consumption, especially binge drinking, is positively and significantly related to accidental deaths. Men who binge drink are nearly four times more likely to die of accidental deaths than are people who do not drink. Based on the observed change in alcohol

<sup>6</sup> Alcohol consumption data for Kazakhstan appear to be substantially in error, so we omit that country from this part of the analysis. Kazakhstan is also omitted from the alcohol regression in column 3 of Table 2.

<sup>7</sup> This figure is calculated by multiplying the coefficient on alcohol consumption by the log change in the WHO measure of alcohol consumption in Russia over this period ( $.432 \times .450 = .194$ ) and dividing by the log change in external cause mortality in Russia ( $.194/.565 = .34$ ). The contributions of other factors to the increase in death rates in Russia based on the cross-country regressions, discussed below, are calculated similarly.

Table 4

**Analysis of Cross-Country Mortality, by Cause, 1989–2000***(dependent variable: log change in standardized mortality rate, men age 25–64)*

<i>Independent variables (log changes):</i>	<i>External causes</i>	<i>Cardiovascular disease</i>	<i>All other causes</i>
<i>Alcohol consumption<sup>a</sup></i>	.432 (.379)	.221 (.137)	.177* (.093)
N	22	22	22
R <sup>2</sup>	.084	.079	.107
<i>Fruit and vegetable consumption<sup>a</sup></i>	-.145 (.304)	-.277** (.123)	-.171 (.137)
N	23	23	22
R <sup>2</sup>	.008	.095	.090
<i>Expectations and stress</i>			
<i>Male suicide rate<sup>b</sup></i>	.590*** (.187)	.229 (.156)	.230a* (.113)
N	23	23	23
R <sup>2</sup>	.354	.125	.281
<i>Survey expectations<sup>c</sup></i>	.886 (.525)	.338 (.605)	.355 (.430)
N	17	17	17
R <sup>2</sup>	.121	.031	.070
<i>Minimum wage/average wage</i>	-.013 (.098)	-.184*** (.059)	-.061* (.034)
N	18	18	18
R <sup>2</sup>	.001	.261	.109

Notes: Robust standard errors are reported in parentheses.

<sup>a</sup> Change between 1992 and 2000 for most countries.

<sup>b</sup> For the external causes regression, the dependent variable is the mortality rate for all causes minus the suicide mortality rate.

<sup>c</sup> Change between 1991/1992 and 1996 for most countries.

\*\*\* Statistically significant at the 1 percent level or less.

\*\* Statistically significant at the 5 percent level or less.

\* Statistically significant at the 10 percent level or less.

consumption, the RLMS data indicate that the increase in alcohol use accounts for 8 percent of the increase in accidental deaths.<sup>8</sup>

### Alcohol and Cardiovascular Disease

Mild alcohol consumption may be good for health, but heavy alcohol consumption may be harmful, by increasing the risk of blood clots (thrombosis) and hemorrhagic stroke and reducing the protective effects of HDL (“good”)

<sup>8</sup> Because the coefficients on the logistic regressions are not directly comparable with those of the cross-country regressions, we re-estimate the RLMS regressions as linear probability models in order to calculate the contribution of each coefficient to the probability of dying.

cholesterol (McKee and Britton, 1998). A small study of adult male deaths in Udmurtia, for example, showed that cardiovascular deaths are strongly associated with heavy drinking (Shkolnikov, Meslé and Leon, 2001). Further, the number of cardiovascular deaths among men in Russia in 1993–1995 was significantly higher on Saturdays, Sundays and Mondays than on other days of the week, which may be connected to increased alcohol consumption on weekends (Chenet, Leon, McKee and Vassin, 1998). However, the fact that mortality increased so much among women, who drink much less, and in the traditional Muslim countries of Uzbekistan and Turkmenistan suggests alcohol may not be so important (Bobak and Marmot, 1999). Further, frequent heavy drinkers are a relatively small group of the population (about 4 percent of Russian men), so it is implausible that their experience can explain much of the overall increase in cardiovascular disease mortality (Malyutina et al., 2002).

To examine the link between alcohol consumption and cardiovascular disease mortality, we use both the cross-section and individual data. Our two data sources differ on the importance of alcohol consumption for cardiovascular disease mortality. The second column of Table 4 shows that alcohol consumption is positively, but not statistically significantly, associated with cardiovascular deaths in the cross-country data. The magnitude is relatively large, even if not statistically significant. An increase in alcohol consumption like that seen in Russia would increase cardiovascular disease mortality by 10 percent. The micro data from the RLMS, in contrast, suggest no impact of alcohol consumption on cardiovascular mortality. The coefficient implies a slight protective effect of drinking for cardiovascular health, but is not statistically significant.

### **Total Effect of Alcohol on Mortality**

The total effect of alcohol consumption on mortality in the international data is shown in Table 2. Greater alcohol use is positively and statistically significantly related to mortality: the increase in alcohol consumption in Russia explains about 25 percent of the increase in mortality in Russia between 1989 and 2000.

The RLMS data also suggest an effect of alcohol consumption on mortality from all causes, as shown in the second column of Table 3.<sup>9</sup> The increase in alcohol consumption seen in Russia over 1989–2000 is predicted to increase mortality by 13 percent, which is 22 percent of the total increase in mortality. The estimates from the micro and macro data for overall mortality impacts are thus consistent: about one-quarter of the increase in Russian mortality stems from the increase in alcohol consumption over the 1990s.

<sup>9</sup> In other results (not shown), we have divided alcohol into different types. Vodka and samogon (homemade alcohol) seem to be most harmful to health, while wine consumption appears to be protective.



## **Suspect 4: The Composition of the Diet**

While weight has fluctuated little in Russia over the course of the transition, Russian households have responded to the income shocks by shifting the composition of their diets toward cheaper foods. This dietary shift may be one of the causes of the increase (and subsequent decrease) in cardiovascular mortality among the population (Ginter, 1996, 1998).

When cells metabolize oxygen, they produce “free radicals,” natural byproducts that travel through surrounding cells and damage them. Antioxidants from consuming fruit and vegetables neutralize the effects of these free radicals. The Russian diet has long been low in fruit and vegetable content, due to the difficulty of growing such foods in the Russian climate and the priority placed by the country’s leadership, beginning with Khrushchev, on increasing the consumption of meat and dairy products. As a result, research has shown severe antioxidant deficiencies in some Russian populations. For example a 1992 study found that 93 percent of men living in Karelia, Russia, had severe vitamin C deficiency, as compared with 2 percent of Finnish men in a neighboring region (Matilainen et al., 1996). Although fruits and vegetables became much more widely available in Russia as market reforms were implemented in the early 1990s, consumption of these goods remained extremely low in comparison with western countries and declined sharply during the first half of the decade. Consumption of fruits and vegetables increased as Russian incomes stabilized after 1994, then fell sharply again following the 1998 financial crisis. This decline, rise and then fall in vegetable consumption roughly tracks the changes in male life expectancy in Russia.

Meat consumption is also much lower in Russia than in the west and was declining over the time period. But meat may have a positive or negative effect on health, especially the fatty meats commonly consumed in Russia.

Two recent studies suggest that these dietary imbalances may heighten the risk of cardiovascular disease in the former Soviet population. A study of 50-year old Lithuanian and Swedish men conducted in 1993–1994 showed that plasma concentrations of antioxidant vitamins were lower in Lithuanian men than Swedish men; the authors argue that antioxidant deficiency likely contributes to the much higher mortality rates from coronary heart disease among Lithuanian men compared with Swedish men (Kristenson et al., 1997). A study of St. Petersburg residents showed a dramatic increase in the number of men with dangerously low levels of HDL cholesterol in the 1990s: in 1986–1988, 6 percent of St. Petersburg men age 40 to 49 had low levels of HDL cholesterol; by 1995–1997, 36.4 percent of men in this age group had low levels of HDL cholesterol (Plavinski et al., 1999).

Dietary change may also be one of the few factors that can explain (in part) the divergent patterns of mortality across eastern Europe and the former Soviet Union (Bobak, Škodová, Pisa, Poledne and Marmot, 1997; Poledne and Škodová, 2000; Zatonski et al., 1998). Across eastern Europe, price liberalization, the removal of subsidies and an increase in food imports led to a dramatic reduction in the relative

price of fruits and vegetables, and a significant increase in their consumption, in marked contrast to what happened in Russia.

Cross-country regression results for the impact of the change in fruit and vegetable consumption on the overall change in mortality rates are presented in the fourth column of Table 2. The coefficient on fruit and vegetable consumption is negative as expected, but is statistically significant only at the 16 percent level. As Table 4 shows, increased fruit and vegetable consumption is statistically significantly negatively associated with cardiovascular disease mortality. Even taken at face value, however, the impact of changes in the composition of the diet for overall mortality is small. Fruit and vegetable consumption in Russia fell by less than 4 percent over the entire time period, implying a change in mortality only 3 percent of what was observed.<sup>10</sup>

While declining fruit and vegetable consumption cannot explain the increase in Russian mortality over the 1990s, it might be a factor in the early part of the crisis. Over the 1992–1994 period, the decline in fruit and vegetable consumption in Russia explains 28 percent of the increase in cardiovascular disease mortality. Also, the change in diet is a distinguishing factor between Russia and eastern Europe. If fruit and vegetable consumption in Russia had mirrored that in Slovenia between 1992 and 2000, our regression results suggest that Russian mortality would have fallen by nearly 10 percent over the 1990s, narrowing the prime-age male mortality gap with eastern Europe by nearly 50 percent.

### **Suspect 5: Material Deprivation**

The transition from communism led to a significant devaluation of human capital. In Russia, for example, the wages of men with 30 or more years of work experience actually fell below the wages of new entrants to the work force (Brainerd, 1998). Coupled with this is a very weak government safety net—weaker in Russia than in many other mortality belt countries. Russia, for example, lacks a national means-tested benefit program for families living below the poverty line. One hypothesis for increased mortality is thus that severe economic hardship increased and this led to increased mortality (Lynch, Smith, Kaplan and House, 2000).

Being underweight is one measure of material deprivation. However, the share of the Russian population that is underweight did not change over the time period.<sup>11</sup> Still, this is only one measure of material deprivation. For example, some

<sup>10</sup> Unfortunately, we cannot examine the dietary composition theory using the RLMS data. The RLMS does ask respondents to provide detailed information on the type and quantity of food consumed in the previous 24 hours, but these data have not yet been released for public use.

<sup>11</sup> Other studies have corroborated the finding that overall nutritional status in Russia is remarkably resilient to the extreme fluctuations in household income that families have experienced in the last decade (Dore, Adair and Popkin, 2003; Thomas and Stillman, 2004).



people might have cut back on heating oil to pay for food, or may have taken work in particularly dangerous jobs. Our RLMS data allow us to examine additional aspects of material deprivation. The third column of Table 3 includes various measures of hardship in the mortality regressions—whether the family is in poverty or extreme poverty;<sup>12</sup> whether the family received subsidies for fuel; whether the family had to sell goods to obtain money for food; and the share of total household expenditures on food. All of these variables are statistically insignificant in these regressions, and many of the coefficients are very small. These results suggest that material deprivation is unlikely to explain the upsurge in mortality in Russia.

### **Suspect 6: Psychosocial Factors**

Before 1989, Russians lived in a country that provided substantial economic security: unemployment was virtually unknown, pensions were guaranteed and provided a standard of living perceived to be adequate, and macroeconomic instability did not much affect the average citizen. The economic reforms implemented in the early 1990s meant that for the first time, the average Russian confronted a highly unpredictable future.

Unpredictability is an example of a psychosocial factor that may influence health. The impact of stress on health is the most explored factor. "Stress" arises when an individual perceives a discrepancy between the demands of a situation and the physical or psychological capacity to respond to those demands (Shapiro, 1995). A high level of stress seems related to the development of cardiovascular disease, although the physiological mechanisms by which this occurs is not yet clear (Labarthe, 1998).

Other psychosocial factors may affect health as well. Greater despair or hopelessness among middle-aged men is associated with higher risk of heart disease and heart attack, as well as earlier onset of artery disease, even controlling for risk factors such as alcohol consumption and smoking (Everson et al., 1997). People who have more social support are similarly likely to have improved outcomes over those with less support (Berkman, Leo-Summers and Horwitz, 1992).

A number of indicators suggest increased psychosocial problems in the former Soviet Union, especially Russia. As noted above, suicide rates rose dramatically in the early years of transition, particularly among middle-aged men. By 1994, the suicide rate for Russian men aged 50–54 was over six times higher than in the United States. In contrast, suicide rates remained constant or fell in eastern Europe.

Russians also tend to have more negative expectations about the future than do their east European counterparts. The Central and East European Barometer

<sup>12</sup> The poverty measure is based on the official Russian poverty measure, which in turn uses a representative subsistence food basket and a food to total expenditure multiplier to determine the poverty line. A household is in extreme poverty if its income is less than half of the poverty line.



(CEEB) program has conducted surveys of Russia and eastern European countries since the early 1990s, available at (<http://www.icpsr.umich.edu>). We focus on a question about future financial circumstances: "Over the next twelve months, do you expect that the financial situation of your household will: (1) get a lot better; (2) get a little better; (3) stay the same; (4) get a little worse; (5) get a lot worse." In 1992, Russian men aged 25–64 had an average score of 3.45 on this question, which was more pessimistic than most other countries in the region (Armenians and Hungarians were the most pessimistic populations of all; Russians were third). For most of the more successful east European countries, this indicator suggests a more positive outlook on the future; for example, in the Czech Republic and Slovenia the average responses among this group in 1992 were 3.15 and 2.83, respectively.

The CEEB program asked this expectations question from 1991 to 1996, and the RLMS started asking a similar question in 1994. Specifically, the RLMS asked: "Do you think that in the next twelve months your family will live better than today, or worse?" Answers range from "much better (= 1)" to "much worse (= 5)." The RLMS and CEEB measures for Russia are nearly identical in the years in which they overlap. The combination of the surveys indicate surprisingly little change in future expectations from 1991 to 1998. After 1998, Russians started to view the future more optimistically, and by 2002 the score for Russian men aged 25–64 was 2.89.

We begin the empirical examination of psychosocial theories by relating changes in overall mortality to changes in suicide rates, the broadest measure of psychosocial distress. Table 2 shows cross-sectionally that the male suicide rate is positively and significantly correlated with the change in the overall death rate. The coefficient is reasonably large; one-quarter of the overall increase in mortality in Russia over the time period is associated with increases in suicide. Of course, suicide is a part of total mortality, but the impact here is substantially greater than just the direct effect. The direct effect of suicide on mortality is only about 4.5 percent of the total mortality increase for men and 1 percent for women, as shown in Table 1. Table 4 shows that suicide is significantly correlated with nonsuicide other external causes of death, but not cardiovascular disease mortality.

Our ability to test specific theories of psychosocial distress is limited, but we can examine some possible explanations. We start by relating mortality to expectations about the future. We use the log change in the average value of the CEEB indicator (for men aged 25–64) between 1991 or 1992 and 1996 as our measure of future expectations; an increase in this value indicates more pessimism about the future. Column 6 of Table 2 shows that countries where expectations got worse had increases in mortality, although the coefficient is not statistically significantly different from zero.

At the individual level, the fourth column of Table 3 relates mortality to an indicator of whether the person is likely to live much or somewhat better in the next year. Men who have positive expectations about the future are 30 percent less likely to die than are men with worse expectations (the coefficient is significant at the 11.3 percent level); in a parallel regression for women, the odds of dying are

50 percent lower. Note that this effect is found controlling for income; thus, this finding shows that those suffering economic stress are in worse health, even given their income.

While expectations are important for health, the time series of expectations makes clear that changes in outlook for the future cannot be the whole explanation for the increase in mortality in Russia. Expectations about the future improved slightly in Russia in the early years of transition, then worsened after 1993, and by 1996 were back to the same level as the early 1990s. Over this time period, however, mortality increased substantially. Moreover, expectations improved substantially after the initial shock of the 1998 financial crisis, but mortality rates increased.<sup>13</sup>

Psychosocial distress may be related not to average expectations about the future, but to stress associated with the fear of very bad outcomes. To test this hypothesis, we relate changes in mortality rates across countries to the change in the minimum wage as a percentage of the average wage. We choose the minimum wage relative to the average wage as our measure of poor outcomes because of its direct effect on wages, because many countries use the minimum wage as a base for setting the level of other social benefits such as child-care allowances and student stipends, and because other measures of government support such as the level of unemployment benefits or government spending on social benefits are not consistently available.

In Russia, the minimum wage fell from 30 to 35 percent of the average wage in the late 1980s to less than 6 percent of the average wage by 2000. This reduced minimum wage is far below—over 75 percent below—the “subsistence minimum” calculated by the government for determining poverty rates. In contrast, many east European countries maintained a relatively high minimum wage throughout the 1990s: for example, 34 percent of average wages in Poland and 42 percent of average wages in Hungary in 2001.

The last column of Table 2 shows that changes in the minimum wage as a share of the average wage are negatively and significantly related to changes in mortality. This is particularly true about cardiovascular disease mortality, as shown in Table 4. The coefficient on the minimum wage in Table 2 indicates that the reduction in the minimum wage can explain 34 percent of the increase in deaths in Russia over the 1989–2000 period.

We also included the minimum wage as a share of the average wage for different regions of Russia in regressions using the RLMS data. As the last column of Table 3 shows, this variable is statistically insignificant in the regressions for all causes mortality; however, it is related to cardiovascular disease mortality at the 8 percent level. The coefficient on the minimum wage is large; changes in the minimum wage can explain nearly all of the increase in male cardiovascular disease deaths in Russia, and roughly 40 percent of the increase in all male deaths in the country.

<sup>13</sup> There might, of course, be a lagged effect of expectations on health, but our data are not refined enough to permit such an analysis.



Recall that the minimum wage is not a proxy for poor individual circumstances. Direct measures of material deprivation such as poverty and having enough food do not predict mortality. Rather, mortality appears to be associated with the prospect of suffering a substantial reduction in income and, hence, living standards.

Both our micro and macro data thus show clear impacts of psychosocial factors on mortality. Our best estimate is that psychosocial distress explains about one-quarter of the increase in mortality over time. Our best guess is that this outcome is related to the increased fear of very low incomes brought about by economic dislocation and the absence of a social safety net, though the exact factors behind this effect still require some work.

## Conclusion

Our analysis of mortality in Russia and other countries of the former Soviet Union leads us to highlight two significant causes of the mortality crisis. The first cause is increased alcohol consumption. Our results in the cross-country and micro data are fairly consistent; in each case, about a quarter of the increase in mortality in Russia is due to increased alcohol use. Much of this alcohol use is a reflection of the lower price of alcohol over time, though factors such as the loosening of the Gorbachev-era restrictions on alcohol availability almost certainly played a role as well. Increased stress from the transition to a market economy also seems to play a role in Russia's mortality crisis. We suspect that another quarter of the mortality increase results from the stress of transition. Other theories for higher Russian mortality, like a reduction in the effectiveness of medical care or changes in diet find little support in our data—though more favorable dietary changes in eastern Europe seem to explain some of the good demographic news enjoyed by those countries.

Approximately half of the mortality reduction is unaccounted for by the factors we identify. Perhaps the factors we identify are the right ones, and the uncertainty of these estimates encompasses the full mortality change. Alternatively, researchers need to identify other factors to explain Russian mortality crisis.

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